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Project Name: MIRIAM SPRINGS BHP JV

Title: EXPLORATION LICENCE NO 4664
FINAL REPORT 8TH JANUARY, 1987 - 6TH DECEMBER, 1988

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Author/s: P.D. WILSON

Approved: J. JOYCE

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Abstract: A reconnaissance stream sampling programme was carried out over Exploration Licence 4664 in 1987. Twenty-two samples were collected, of which 4 returned positive results. The majority of these results were single chromite grains but one sample, BC0934, contained 55 chromite grains. This sample was followed up with further sampling in 1988.

Additional chromite grains were recovered but the erratic abundances reported and their proximity to the Katherine River, which is known to carry chromite, suggest that they are the result of overbank sedimentation from this river.

Exploration Licence 4664 was relinquished on 6 December, 1988.

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STOCKDALE PROSPECTING LIMITED

MIRIAM SPRINGS BHP JV

EXPLORATION LICENCE 4664

FINAL REPORT TO 6TH DECEMBER, 1988

P.D WILSON

FEBRUARY, 1989

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SUMMARY

EXPLORATION LICENCE:	4664
DATE GRANTED:	8 January, 1987 JV with BHP approved 1 May, 1987
DATE RELINQUISHED:	6 December, 1988
AREA:	312 sq.km. (98 blocks)
OCCUPANT:	BHP
OPERATOR:	Stockdale Prospecting Limited
COMMODITY SOUGHT:	Diamonds
EXPLORATION:	A reconnaissance stream sampling programme was carried out over EL 4664 in 1987. Twenty-two samples were collected, of which 4 returned positive results. The majority of these results were single chromite grains but one sample, BC 0934, contained 55 chromite grains. This sample was followed up with further sampling in 1988. Additional chromite grains were recovered but the erratic abundances reported and their proximity to the Katherine River, which is known to carry chromite, suggest that they are the result of overbank sedimentation from this river. Exploration Licence 4664 was relinquished on 6 December, 1988.

STOCKDALE PROSPECTING LIMITED

EXPLORATION LICENCE 4664 : MIRIAM SPRINGS

FINAL REPORT FOR THE PERIOD

8 JANUARY 1987 TO 6 DECEMBER 1988

1. INTRODUCTION

Exploration Licence 4664 occupies an area of 312 sq.km. centred 16 km northeast of the town of Katherine (1:250 000 mapsheet, SD 53/9).

This final report covers diamond exploration carried out by Stockdale Prospecting Limited within EL 4664 during the two years, 8 January 1987 - 6 December 1988.

2. LEGAL

2.1 General

Exploration Licence 4664 was granted to BHP Minerals Limited on 8 January 1987 for a term of six years.

Stockdale entered a farm-in and joint venture agreement with BHP covering the area of Exploration Licence 4664 on 1st May 1987 and this agreement was approved by the Northern Territory Department of Mines and Energy on 26 November 1987 (Appendix 1).

Results of diamond exploration within Exploration Licence 4664 have been unfavourable and the licence was relinquished on 6 December 1988.

2.2 Aboriginal Land Claim

The Exploration Licence partly lies in the Jawoyn land claim lodged 31 March 1978. Due to the land claim status Stockdale obtained permission from the Traditional Owners, at a meeting held in conjunction with the Northern Land Council at the Rock Hole on 24 March 1987, for agreement to sample and camp within the area. All sample sites were cleared by consultation and site inspection.

Information regarding sacred sites on the area was obtained from the Sacred Sites Authority.

Further approval for the 1988 exploration programme was gained at a meeting at Eva Valley Station on 11 February 1988 (Appendix 2).

3. ACCESS

The northern part of the licence area is rugged woodland and access is poor, but in the south a fire trail on Ironwood Station provides limited vehicular access. For this reason field work was carried out by helicopter in the north and vehicle in the south.

4. PHYSIOGRAPHY, VEGETATION AND CLIMATE

4.1 Physiography

Two physiographic domains fall within Exploration Licence 4664. The plain of the Daly River Basin occupies the southern part of the licence area and this plain laps onto the elevated edge of the Edith Falls Basin to the north. The edge of the Edith Falls Basin is a rugged area consisting of an escarpment of Kombolgie Sandstone and Volcanics on which a distinctive dendritic and rectangular drainage pattern has developed.

4.2 Vegetation

Dense woodland dominated by eucalyptus lies to the north of the Katherine River. Growth of the understory is dependant upon the prevailing climatic conditions and varies in density between the wet season and the dry season.

To the south, where grazing is the principal land use, vegetation is sparse.

4.3 Climate

The licence area is subject to a tropical monsoon climate. Summers are humid with periods of very high rainfall (up to 150cm) while the winters are hot and dry.

5. GEOLOGY

5.1 General

Descriptions of the rock units in the Katherine area are detailed in the Bureau of Mineral Resources (BMR) Record 1986/87 for the Edith River Region which covers the 1:100,000 Katherine mapsheet. A compilation of field work carried out in 1982-1983 by the Pine Creek Geological Party (BMR and NT Geological Survey) on the Katherine 1:100,000 mapsheet has been prepared (Needham, et al 1986) and the geology of the area is summarised in the abstract of this publication.

"The region is dominated in the west by a large mass of granite which forms the southernmost part of the late Early Proterozoic Cullen Batholith, and in the east by a basin of interlayered sandstone and basalt ("Edith Falls Basin"), which represents a thickened sequence of Middle Proterozoic Kombolgie Formation at the western edge of the MacArthur Basin.

The granite complex and sandstone basin are separated by a northerly belt of low-grade Early Proterozoic sediments, which in the north (Burrell Creek Formation) belongs to the the Pine Creek Geosyncline sequence. The southern part of this belt (Tollis Formation) and felsic volcanics and minor sediments of the Plum Tree Creek Volcanics and Phillips Creek Sandstone, represent an unconformity-bounded late Early Proterozoic suite separating the Pine Creek Geosyncline sequence from the McArthur Basin sequence, which is approximately coeval with the Cullen Batholith and Yenberrie Granite.

The Proterozoic rocks are overlain by thin Mesozoic sediments in the northwest and northeast, and by Cambrian basalt and sediments forming the edge of the Daly River Basin in the south and southwest".

5.2 Stratigraphy

The stratigraphy of the area is summarised in Table 1.

6. DIAMOND EXPLORATION

6.1 General

Exploration Licence 4664 is well drained and the most effective approach to diamond exploration in this area was considered to be heavy mineral stream sampling.

Prior to the commencement of field work a review of the reports written by previous mineral explorers was carried out. Aeromagnetic and INPUT geophysical data collected by the Mineral Reserves Group over Exploration Licences 2260, 2262, 2265, 2266 and 2267 were recovered and evaluated for possible use by Stockdale but no targets were identified that required individual follow-up.

The black and white 1:80,000 aerial photographs covering the area of Exploration Licence 4664 were examined. Two circular photofeatures were identified as possible surface expressions of diatremes and were recommended for field examination.

6.2 1987 Field Season

Fieldwork carried out during July and August consisted of the collection of stream sediment samples from the various drainages in the area. Samples were taken approximately 8 kms apart along the individual drainages. The material collected was hand screened on site. The size fraction retained was -2.0 +0.4mm for both stream and barrage samples (unless samples were wet in which case only a 4.75mm screen was used). Sample size varied from 40 to 400 kgs. Samples statistics are summarised in Table 2.

TABLE 2 : SAMPLING STATISTICS

TYPE OF SAMPLE	NO. OF SAMPLES	TOTAL WEIGHT (KGS)	APPROX. AVERAGE WEIGHT (KGS)
Stream	18	960	53
Barrage	4	1020	255
Total	22	1980	

Table 1: Summary of Stratigraphy of the Edith River Region, N.T.

		Unit	Description	Field Relationships
MESOZOIC		CRETACEOUS K	Fine to coarse commonly ill-sorted and friable ferruginous sandstone, pebbly in places; conglomerate, porcellanite kaolinite; rare fossils.	Unconformable on older units; forms low areas commonly with wide sandy aprons.
		U N C O N F O R M I T Y		
PHANEROZOIC (CAMBRIAN)	DALY RIVER GROUP	TINDAL LIMESTONE €mt	Grey crystalline limestone with chert nodules, flaggy limonitic silty limestone, buff-orange well-sorted sandstone.	Overlaps Jindare Sandstone in places.
		JINDARE SANDSTONE €lw	Massive, laminated and brecciated chert, sandstone, arkose, siltstone, conglomerate; rare calcite crystals <3 cm.	Upper part conformable on Antrim Plateau Volcanics, lower part infingers with it.
		ANTRIM PLATEAU VOLCANICS €la	Massive dark grey basalt, vesicular in places, minor jasper and chert; interbedded medium-grained equigranular to conglomeratic sandstone near base.	Unconformable on older units.
		U N C O N F O R M I T Y		
PROTEROZOIC	TOLMER GROUP	DEPOT CREEK SANDSTONE Ptd	Mainly medium-grained equigranular pink quartzite, in places, minor jasper and chert; interbedded medium-grained equigranular to conglomeratic sandstone near base.	Unconformable on older units
		U N C O N F O R M I T Y		
MIDDLE			Fine dolerite dykes	Cut Kombolgie Formation and older units as an ENE-trending swarm.

MIDDLE PROTEROZOIC	KATHERINE RIVER GROUP	KOMBOLGIE FORMATION k_1, Bhk_2	Massive or cross-bedded medium-coarse buff-grey sandstone, pebbly in places, conglomerate beds mainly near base, rare siltstone beds.	Comprise a conformable sequence, itself unconformable on older units. Slight angular unconformity on Plum Tree Creek Volcanics, major angular unconformity elsewhere.
		HENWOOD CREEK VOLCANIC MEMBER Bhh	Partly amygdaloidal andesite and basalt, tuff	
		McADDENS CREEK VOLCANIC MEMBER Bhm	Fine grey-green basalt - andesite, vesicular in places, banded purple - cream tuff.	
		U N C O N F O R M I T Y		
		YENBERRIE GRANITE Bgl_c, Bgl_d	Coarse pink and fine white and pink leuco-granite, commonly altered and greisenised	Intrudes and hornfelses Burrell Creek Formation; probably continuous at depth with Cullen Batholith.
		LEWIN SPRINGS SYENITE Bew	Grey-pink glassy to very fine equigranular or porphyritic syenite, rhyolite and microgranite dykes, rarely flow-banded.	Intrudes Cullen Batholith and Fergusson River Toscanite.
EARLY PROTEROZOIC		CULLEN BATHOLITH $Bgc_{a,c,d,e,h,i,k\ l,m,o,z}$	Fine to coarse equi-granular to porphyritic leuco-granite, granite and granodiorite with rafts and screens of cordierite hornfels	Four plutons, two of leucogranite, one of mainly granodiorite, and one of granite and leucogranite. Intrude and hornfels Burrell Creek Formation Tollis Formation, and Fergusson River Toscanite; cut by Lewin Springs Syenite.
	EDITH RIVER GROUP	PLUM TREE CREEK VOLCANICS Bep	Red-brown glassy to fine ignimbrite, red and mauve banded agglomeratic rhyolite, massive and amygdaloidal basalt, minor cherty and sandy	Conformable sequence of mainly felsic volcanics with intermediate to mafic flows in lower part of sequence. Conformable on Phillips Creek

			sediments and massive to laminated tuff; porphyritic andesite in Edith Falls area	Sandstone. Elsewhere highly angular unconformity on older units.
PROTEROZOIC	EDITH RIVER GROUP	MOUNT SHEPHERD RHYOLITE MEMBER	Purple-cream banded rhyolite	Forms possible rhyolite dome in southeast of region.
		'FERGUSSON RIVER TOSCANITE' Bef	Red-brown glassy to fine ignimbrite	Correlative of similar ignimbrite within Plum Tree Creek Volcanics. Highly angular unconformity on older units, except for conformity with Phillips Creek Sandstone. Intruded by Tennysons Leucogranite.
		PHILLIPS CREEK SANDSTONE Bel	Fine to coarse, partly tuffaceous, and in places pebbly, sand-stone, arkose, conglomerate	Highly angular unconformity on older units, conformable beneath other units of the group.
			U N C O N F O R M I T Y	
		MAUD DOLERITE Bdm	Fine pink-grey to coarse grey-green ophitic dolerite	Hornfelses Tollis Formation, unconformable under Kombolgie Formation.
EARLY	EL SHERANA GROUP	TOLLIS FORMATION Bbt_1, Bbt_2, Bbt_3	Interbedded greywacke, siltstone, argillite, tuff and minor phyllite, feldspar porphyry flow rock	Unconformable relationship with Burrell Creek Formation interpreted from differing fold styles. Cut by dolerite, porphyry and felsite dykes.
		DOROTHY CREEK BASALT MEMBER Bbt_d	Basalt, minor banded chert and tuff	Conformable within Tollis Formation.
			U N C O N F O R M I T Y	
	FINNISS RIVER GROUP	BURRELL CREEK FORMATION Bfb	Interbedded greywacke, phyllite, slate, meta-siltstone, rare siliceous argillite.	Oldest unit in the Edith River Region.

After collection, samples were consigned to the Company's Treatment Plant in Darwin for processing.

Possibly kimberlitic/lamproitic chromite grains were recovered from four samples. These results are listed in Table 3 and the sample locations are shown on Figure 2.

TABLE 3 : 1987 SAMPLES RESULTS

SAMPLE NO.	TYPE	CHROMITE GRAINS RECOVERED
BC0914	Barrage	1
BC0930	Stream	1
BC0934	Stream	55
BC0941	Barrage	1

The areas of the two photoanomalies noted previously were actively drained and consequently were covered by stream samples, but no indicator minerals were recovered. The anomalies were identified as erosional features or depressions relating to the solution of calcrete which was common in the area.

6.3 1988 Field Season

Fieldwork in 1988 was concerned primarily with the follow-up of sample BC0934 which contained a total of 55 chromites.

Twelve samples, each of 40 kilograms of -2 + 0.4mm gravel, were collected. The results of this follow-up programme are listed below in Table 4 and sample locations are shown on Figure 2.

TABLE 4 : 1988 RESULTS

SAMPLE NO.	TYPE	CHROMITE GRAINS RECOVERED
BC0995	Stream	20
BC0996	Stream	11
BC0997	Stream	1
BC0602	Stream	13
BC0604	Stream	3

7. DISCUSSION OF RESULTS

The creek sampled by BC0934 is a meandering swampy channel which lies within the floodplain of the Katherine River and runs parallel to it for much of its length. The catchment of the creek is only 11 sq.km. and it appears that the creek functions as an overflow channel of the Katherine when it is in flood. The Katherine River is known to carry chromites in its bedload and it is now believed that the chromites recovered from the BC0934 creek system are the result of overbank sedimentation from the Katherine River.

The single chromite grains found in samples BC0930 and BC0941 which were collected in tributaries of the Katherine near their confluences can also be explained in this manner. Baker and Pickup (1987) have identified "slack water deposits" at tributary mouths of the Katherine River within the Katherine Gorge. Sediment charged water from the high velocity main channel flow is conveyed into the low velocity eddy zone which develops at the tributary mouth and the suspended material is rapidly deposited. While the Katherine is not constrained within canyon walls at BC0930 and BC0941 a similar mechanism may account for the accumulation of alluvial material derived from the Katherine within the mouths of these tributaries.

The chromite grain in BC0914 cannot be explained by contamination from the Katherine. The BC0914 sample consisted of about 400 kg of gravel but only a single fine chromite grain was recovered. The catchment of the sample is well drained and small (about 14 sq.km.) and a better result could be expected if a kimberlite or lamproite body were exposed within the catchment. The low abundance of chromite in this sample and the absence of other corroborating indicator minerals combine to suggest that no further work on this area is required.

Exploration Licence 4664 has been sampled at a density of one sample per nine sq.km. and in this well drained country this should be sufficient to locate kimberlite or lamproite bodies if they were present. The lack of results more encouraging than those described above suggests that they are not present and therefore diamond exploration in the area is regarded as complete.

8. PERSONNEL

Fieldwork in Exploration Licence 4664 has included the following staff:

TABLE 5 : MANPOWER

	1987		1988	
	NO.	MANDAYS	NO.	MANDAYS
Geologist	1	7	1	6
Prospecting Hands	3	21	3	9
Cook	1	7	-	
Pilot	1	5	-	
Engineer	1	5	-	

9. EXPENDITURE

Expenditure on diamond exploration over the period of tenure of Exploration Licence 4664 totals $59,643, which has been allocated as shown in Table 6.

The project has been supported by the staff and facilities of the regional office in Darwin and the head office in Melbourne.

P.D. WILSON
Project Geologist

J. JOYCE
Chief Geologist - North

Darwin, NT

OFG:EIP615

TABLE 2 : EXPENDITURE SUMMARY TO 6/12/88

BHP - MIRIAM SPRINGS JV

	EL 4664
OPERATIONAL STAFF COSTS	11231
GENERAL OPERATIONAL EXPENSES	875
AIR CHARTER	9555
TRANSPORT AND TRAVEL	439
LABORATORY : TREATMENT	3659
: EXAMINATION	5104
CENTRAL TREATMENT PLANT	16453
ADMINISTRATION : HEAD OFFICE	6293
: REGIONAL OFFICE	3422
CAPITAL UTILISATION	2292
DRAFTING	320
TOTAL EXPENDITURE	59643

REFERENCES

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Flood Geomorphology of the Katherine Gorge, Northern Territory, Australia, Geol. Soc. Am. Bull., Volume 98, pp 635-646.

RANDAL, M.A. 1963.
Katherine - 1:250,000 series Geological Explanatory Notes. BMR Publication.

NEEDHAM, R.S., STUART-SMITH, P.G., BAGAS, L. 1987.
Record 1986/7, Edith River Region, Northern Territory; Data Record of 1:100,100 Mapping. BMR Publication.

APPENDIX 1

EXTENSION OF JOINT VENTURE AGREEMENT

Department of Mines and Energy

HEAD OFFICE MINERALS HOUSE ESPLANADE DARWIN, N.T. 5790
G.P.O. BOX 2901, DARWIN, N.T. 5794
TELEPHONE (089) 81 5844, TELEX AA85473, VOCADEX (089) 81 4806

TITLE REGISTRATION BRANCH

IN REPLY PLEASE QUOTE: D 4572
EL4664

Mr S A Johnson
BHP Minerals Limited
PO Box 559
CAMBERWELL VIC 3124

Dear Mr Johnson

D4572 Agreement Between BHP Minerals Limited
And Stockdale Prospecting Ltd.

The abovementioned agreement was approved on 26 November 1987 and registered on 9 December 1987 by the delegate of the Minister for Mines and Energy against Exploration Licence 4664

In the event that the Agreement lapses or is otherwise terminated, the Department should be advised so that an appropriate endorsement can be made on the register.

You are reminded that pursuant to the Mining Act, not withstanding the contents of this registered agreement, the title holder has the responsibility to maintain the good standing of a title in respect of all legislative requirements.

Yours sincerely

JANECE BARNES
Mining Registrar
9 December 1987.

CMC:CM118:343

APPENDIX 2

ABORIGINAL LIAISON

Northern Land Council

HIGHWAY ARCADE, 47 Stuart Highway, Darwin N.T. 5790
Telephone Enquiries: (089) 81 7011
Telex: AA85042
Facsimile Phone: (089) 81 6899

P.O. Box 39843,
Winnellie, N.T. 5789
Address all Correspondence to:
THE CHAIRMAN

SPL
18 FEB 1988
NT

IN REPLY PLEASE QUOTE:

16 February 1988

86/230 (M11)

Mr S.C. Verco
Divisional Geologist
Stockdale Prospecting Limited
5 Searcy Street
DARWIN NT 5790

Dear Sir,

Further to our meeting of 11 February 1988 at Eva Valley Station I now confirm that the traditional owners of the Jawoyn Association have given approval for the Prospecting Programme as outlined in your document "Jawoyn, Eva Valley Land Claims, 1988 Stockdale Prospecting Limited Work Programme" to proceed.

This approval is given on the understanding that,

(1) You will pay a sum $100 per week for the period during which your work crews are camped on Eva Valley Station.

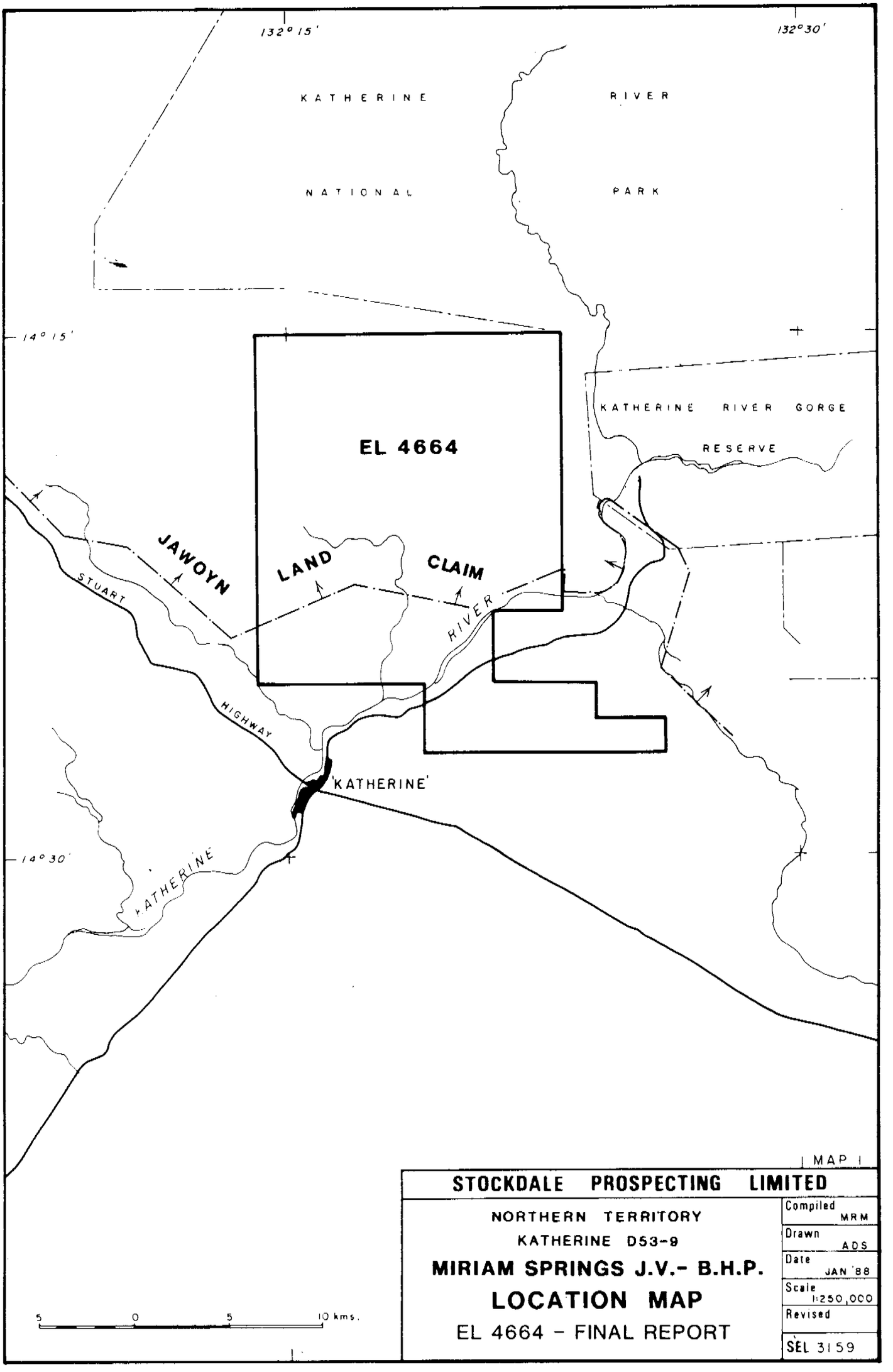
(2) That, as directed by CCNT, the access track you propose to open up to access the Ferguson River will be closed following your exploration activities and that the other access tracks you propose to open will be left in a condition that the Jawoyn people may use that track in their management of the area.

Should you have any queries on this matter please contact Mr A. Jackson at our Darwin office.

Yours faithfully,

Steve Brennan
MANAGER LAND MANAGEMENT

MAPS



MAP 1

STOCKDALE PROSPECTING LIMITED

NORTHERN TERRITORY

KATHERINE D53-9

MIRIAM SPRINGS J.V.- B.H.P.

LOCATION MAP

EL 4664 - FINAL REPORT

Compiled	MRM
Drawn	ADS
Date	JAN '88
Scale	1:250,000
Revised	
SEL 3159	

EL4664

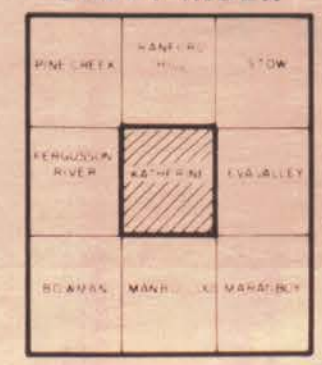
BC0917
BC0922
BC0925
BC0915
BC0920
BC0919
BC0914
BC0926
14°20'
BC0940
BC0927
BC0935
BC0575
BC0574
BC0930
BC0939
Bc0603
Bc0602
BC0942
Bc0601
Bc2187
Bc2188
Bc0604
BC0933
Bc2186
Bc2185
Bc2183
BC0943/44
RIVER
Bc0996
Bc0997
BC0941
Bc0994
Bc0995
BC0938
KATHERINE
ST. LAWR.
KATHERINE
HIGHWAY
132°20'
10
20

0 2 4Km

○BC0938 Sample location with number

● Chromite

SHEET INDEX



SD53-9 KATHERINE

STOCKDALE PROSPECTING LIMITED

NORTHERN TERRITORY
KATHERINE RIVER D53-9

EL 4664 - FINAL REPORT

SAMPLE LOCATION MAP

Compiled	PDW
Drawn	HMR
Date	2/89
Scale 1:100000	
Revised	
SEL 3551	

CR89/339